Summary of Circuits so far...

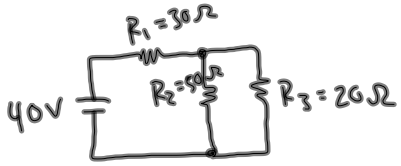
- Combining resistors:
  - Series

$$R_{eq} = R_1 + R_2$$

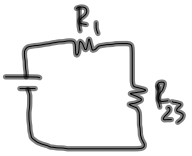
  - Parallel

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

- Equations:
  1. Ohm's law → $V = IR$
  2. Power eqn. → $P = IV = I^2R = \frac{V^2}{R}$
  3. Energy eqn. → $E = Pt$
  4. Kirchoff's Voltage law → voltage drops are equal to voltage gains
  5. Kirchoff's current law → current into junction = current out junction



$V_1 =$ $V_2 =$
$I_1 =$ $I_2 =$
$V_3 =$
$I_3 =$



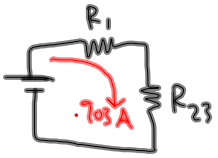
$$\frac{1}{R_{23}} = \frac{1}{R_2} + \frac{1}{R_3}$$

$$R_{23} = 14.3\Omega$$

$$R_{eq} = R_1 + R_{23}$$
$$= 44.3\Omega$$

$$V_{total} = I_{total} R_{eq}$$

$$I_{total} = \frac{40V}{44.3\Omega} = 0.903A$$



$$V_1 = I_{total} R_1$$
$$= (.903A)(30\Omega)$$
$$= 27.1V$$

$V_1 = 27.1V$
$I_1 = .903A$

$$V_{23} = I_{total} R_{23}$$
$$= (.903A)(14.3\Omega)$$
$$= 12.9V$$

$$V_{23} = I_2 R_2$$
$$I_2 = \frac{12.9V}{50\Omega}$$
$$= 0.258A$$

$V_2 = 12.9V$
$I_2 = 0.258A$

$V_3 = 12.9V$
$I_3 = 0.645A$

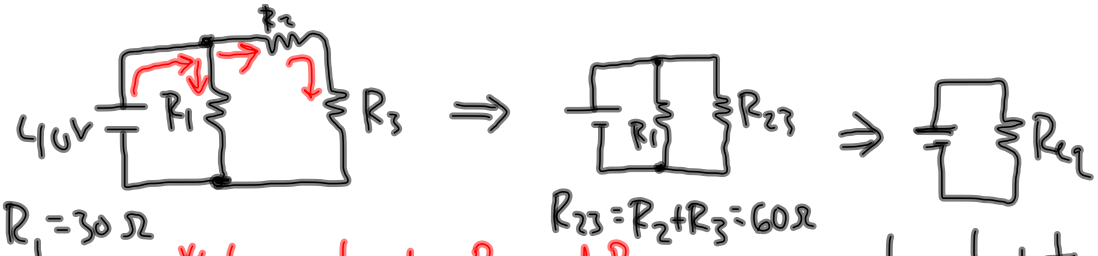
$$V_{23} = I_3 R_3$$
$$I_3 = \frac{12.9V}{20\Omega}$$
$$= 0.645A$$

$$P_{total} = I_{total} V_{total}$$
$$= (.903A)(40V)$$
$$= 36.1W$$

$$P_1 = I_1 V_1$$

$$P_2 = I_2 V_2$$

$$P_3 = I_3 V_3$$



$R_1 = 30\,\Omega$

$R_2 = 50\,\Omega$

$R_3 = 10\,\Omega$

$R_{23} = R_2 + R_3 = 60\,\Omega$

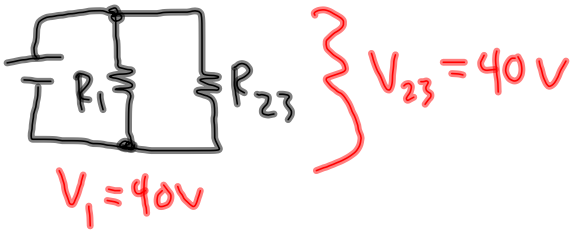
* have to do R_2 and R_3 in series before combining with R_1

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_{23}}$$

$$R_{eq} = 20\,\Omega$$

$$V_{total} = I_{total} R_{eq}$$

$$I_{total} = \frac{40\,V}{20\,\Omega} = 2\,A$$



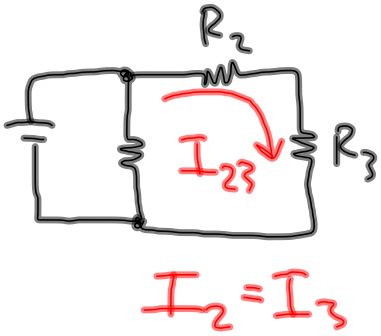
$$V_1 = I_1 R_1$$

$$I_1 = \frac{40\,V}{30\,\Omega} = 1.33\,A$$

$$V_{23} = I_{23} R_{23}$$

$$I_{23} = \frac{40\,V}{60\,\Omega}$$

$$= .667\,A$$



$$V_2 = I_2 R_2$$

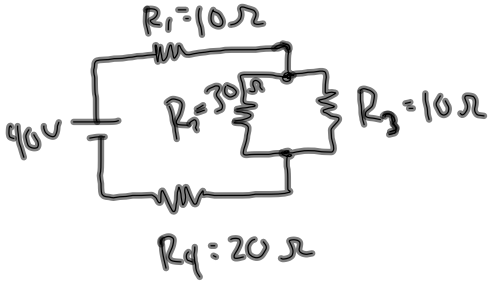
$$= (.667A)(50\,\Omega)$$

$$= 33.3\,V$$

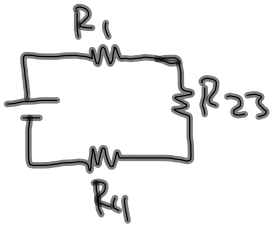
$$V_3 = I_3 R_3$$

$$= (.667A)(10\,\Omega)$$

$$= 6.67\,V$$



$\Rightarrow$

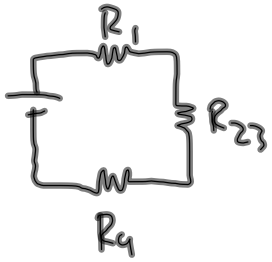


$$\frac{1}{R_{eq}} = \frac{1}{R_2} + \frac{1}{R_3} \qquad R_{eq} = 7.5\Omega$$

$$R_{eq} = R_1 + R_{23} + R_4$$
$$= 37.5\ \Omega$$

$$V_{total} = I_{total} R_{eq}$$

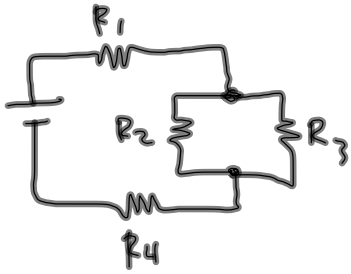
$$I_{total} = \frac{40\ V}{37.5\Omega} = 1.07\ A$$



$$V_1 = I_{total} R_1$$
$$= (1.07A)(10\Omega)$$
$$= 10.7\ V$$

$$V_{23} = I_{total} R_{23}$$
$$= (1.07A)(7.5$$
$$= 8\ V$$

$$V_4 = I_{total} R_4$$
$$= (1.07A)(20\Omega)$$
$$= 21.3V$$



$V_{23} = 8\ V$

$$V_{23} = I_2 R_2$$

$$I_2 = \frac{8\ V}{30\Omega}$$

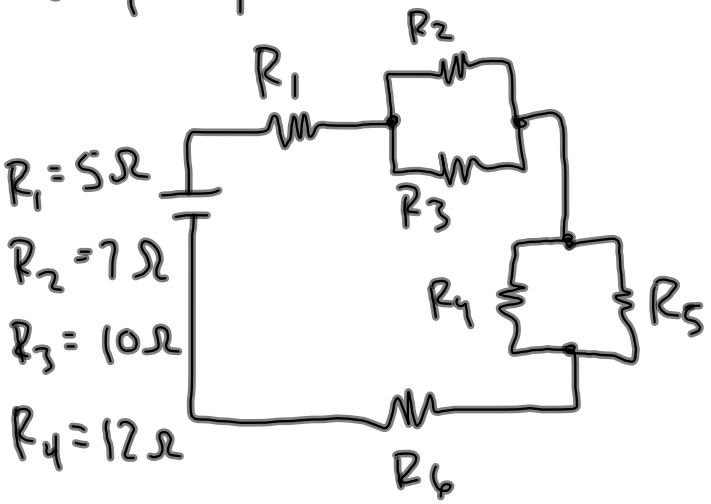
$$= 0.26\ A$$

$$V_{23} = I_3 R_3$$

$$I_3 = \frac{8\ V}{10\Omega}$$

$$= 0.8\ A$$

Simplify this circuit:



$R_1 = 5\Omega$

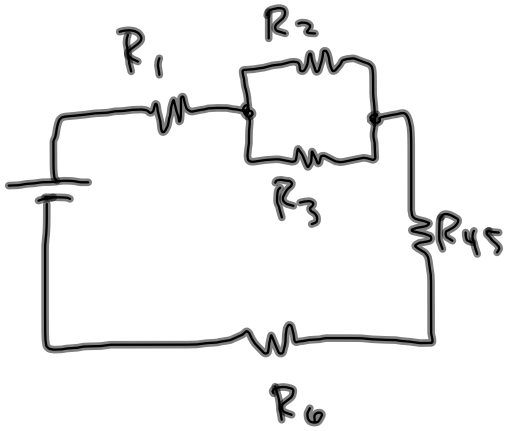
$R_2 = 7\Omega$

$R_3 = 10\Omega$

$R_4 = 12\Omega$

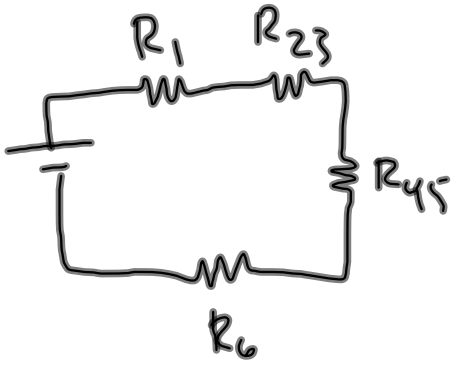
$R_5 = 8\Omega$

$R_6 = 9\Omega$



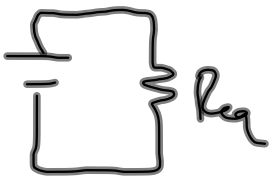
$$\frac{1}{R_{45}} = \frac{1}{R_4} + \frac{1}{R_5}$$

$R_{45} = 4.8\ \Omega$



$$\frac{1}{R_{23}} = \frac{1}{R_2} + \frac{1}{R_3}$$

$R_{23} = 4.1\ \Omega$



$$R_{eq} = R_1 + R_{23} + R_{45} + R_6$$

$$= 22.9\ \Omega$$